PATENT

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Date: 11-8-04

Himanshu S. Amin

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s): Frederick M. Discenzo, *et al.*

Serial No: 09/964,939

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Examiner: Carlos R. Ortiz Rodriguez

Art Unit: 2125

Title: SYSTEM AND METHOD FOR DYNAMIC MULTI-OBJECTIVE OPTIMIZATION OF PUMPING SYSTEM OPERATION AND DIAGNOSTICS

Mail Stop Appeal Brief – Patents
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APPEAL BRIEF

Dear Sir:

Applicants' representative submits this brief in connection with an appeal of the above-identified patent application. A credit card payment form is filed concurrently herewith in connection with all fees due regarding this appeal brief. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [ALBRP220USA].

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I. Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in the present appeal is Reliance Electric Technologies, LLC, the assignee of the present application.

II. Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

Claims 1-42 stand rejected by the Examiner. The rejection of claims 1-42 is being appealed.

IV. Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

No claim amendments have been entered after the Final Office Action.

V. Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))

A. Independent Claim 1

Independent claim 1 recites a method of controlling a system having at least one motorized pump and an associated motor drive, comprising: selecting a desired operating point within an allowable range of operation about a system setpoint according to performance characteristics associated with a plurality of components in the system; and automatically controlling the system according to the desired operating point. (*See e.g.*, page 4, lines 4-16).

B. Independent Claim 23

Independent claim 23 recites a control system for controlling a process having a pump with an associated motor, the control system comprising: a motor drive providing electrical power to the motor in a controlled fashion according to a control

signal, and a controller providing the control signal to the motor drive according to a desired operating point within an allowable range of operation about a process setpoint, wherein the controller selects the desired operating point according to performance characteristics associated with a plurality of components in the process. (*See e.g.*, page 5, lines 11-20).

C. Independent Claim 34

Independent claim 34 recites a control system for controlling a process having a pump with an associated motor, the control system comprising: a motor drive adapted to provide electrical power to the motor in a controlled fashion according to a control signal. (*See e.g.*, page 5, lines 11-14). The system includes means for providing the control signal to the motor drive according to a desired operating point within an allowable range of operation about a process setpoint. (*See e.g.*, page 5, lines 14-16). The system further includes means for selecting the desired operating point according to performance characteristics associated with a plurality of components in the process. (*See e.g.*, page 5, lines 16-17).

The "means for" limitations described above are identified as limitations subject to the provisions of 35 U.S.C. §112 ¶6. The structures corresponding to these limitations are identified with reference to the specification and drawings in the above noted parentheticals.

D. Independent Claim 35

Independent claim 35 recites a control system for controlling a process having at least one motorized pump and an associated motor drive. The system includes means for selecting a desired operating point within an allowable range of operation about a process setpoint according to performance characteristics associated with a plurality of components in the process. (*See e.g.*, page 5, lines 14-16). The system also includes means for controlling the process according to the desired operating point. (*See e.g.*, page 5, lines 16-17).

The "means for" limitations described above are identified as limitations subject to the provisions of 35 U.S.C. §112 ¶6. The structures corresponding to these limitations

are identified with reference to the specification and drawings in the above noted parentheticals.

E. Independent Claim 37

Independent claim 37 recites a pump control system for automatically operating a pump driven by a motor in a controlled fashion, comprising: a motor drive providing electric power to operate the motor in a controlled fashion according to a motor control signal, and a controller comprising a diagnostic component operatively connected to diagnose an operating condition associated with the pump, wherein the controller provides the control signal to the motor drive according to a setpoint and a diagnostic signal from the diagnostic component according to the diagnosed operating condition in the pump. (*See e.g.*, page 4, lines 4-29).

F. Independent Claim 40

Independent claim 40 recites a controller for providing a control signal to a motor drive to operate a motorized pump in a controlled fashion, comprising: a diagnostic component operatively connected to the pump to diagnose an operating condition associated with the pump, wherein the controller provides the control signal to the motor drive according to a setpoint and a diagnostic signal from the diagnostic component according to the diagnosed operating condition in the pump. (*See e.g.*, page 5, line 28-page 6, line 6).

VI. Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi))

A. Claims 1-4, 6, 10, 21 and 22 stand rejected under 35 U.S.C. §102(b) as being anticipated by Irvin (US 5,742,500).

B. Claims 40-42 stand rejected under 35 U.S.C. §102(e) as being anticipated by Hays *et al.* (US 6,260,004).

C. Claims 5, 7-9, 11-20 and 23-36 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Irvin (US 5,742,500) in view of Crane (US 4,584,654).

D. Claims 37-39 stand rejected under 35 U.S.C. §103(a) as being

unpatentable over Irvin (US 5,742,500) in view of Hays *et al.* (US 6,260,004).

VII. Argument (37 C.F.R. §41.37(c)(1)(vii))

A. Rejection of Claims 1-4, 6, 10, 21 and 22 Under 35 U.S.C. §102(b)

Claims 1-4, 6, 10, 21 and 22 stand rejected under 35 U.S.C. §102(b) as being anticipated by Irvin (US 5,742,500). Reversal of this rejection is respectfully requested for at least the following reasons. Irvin fails to teach or suggest each and every limitation of the subject claims.

> A single prior art reference anticipates a patent claim only if it ***expressly or inherently describes each and every limitation set forth in the patent claim***. *Trintec Industries, Inc. v. Top-U.S.A. Corp.*, 295 F.3d 1292, 63 USPQ2d 1597 (Fed. Cir. 2002); *See Verdegaal Bros. v. Union Oil Co. of California,* 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The ***identical invention must be shown in as complete detail as is contained in the ... claim***. *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989) (emphasis added).

i. Irvin fails to teach or suggest all limitations set forth in independent claim 1 and associated dependent claims.

Independent claim 1 recites selecting a desired operating point within an allowable range of operation about a system setpoint ***according to performance characteristics associated with a plurality of components in the system***, and automatically controlling the system according to the desired operating point. It is evident that the invention as claimed provides for controlling a motorized system according to a system setpoint, wherein the system set point is determined according to the performance characteristics of a plurality of components that comprise the system, and that the appropriate or desired operating point is selected from a range around the determined setpoint. Irvin fails to teach or suggest these novel features of the invention as claimed.

Irvin relates to control systems and methods for pumping wastewater. The

Examiner indicates in the Final Office Action dated April 5, 2004, that the substance of the subject claim may be found at col. 1, lines 42-54, and in particular, that the limitation of selecting a desired operating point within an allowable range of operation about a system setpoint ***according to the performance characteristics associated with a plurality of components in the system***, can be found at col. 1, lines 49-54. The noted passage, however, discloses that when a variable speed pump is used, the pump is initially activated at a preset start speed less than 100% of the pump's rated speed, and that the pumps, control levels, and control speeds are usually chosen such that the starting pump outflow exceeds the average inflow. It is submitted that Irvin activates the variable speed pump at a speed less than 100% of the *pump's rated speed*; it is the selection of pumps, control levels and control speeds that are chosen such that the starting pump's outflow exceeds the average inflow. This is in contrast to applicants' claimed invention that effectuates selecting a system setpoint according to *performance characteristics of a plurality of components in the system.* Accordingly, it is believed that independent claim 1 and associated dependent claims are in condition for allowance, and that this rejection should be withdrawn.

B. Rejection of Claims 40-42 Under 35 U.S.C. §102(e)

Claims 40-42 stand rejected under 35 U.S.C. §102(e) as being anticipated by Hays *et al.* (US 6,260,004). Withdrawal of this rejection is respectfully requested for at least the following reasons. Hays *et al.* fails to teach or suggest each and every limitation set forth in the subject claims.

i. Hays et al. fails to teach or suggest each and every limitation set forth in independent claim 40 and claims that depend there from.

Independent claim 40 recites a controller for providing a control signal to a motor drive to operate a motorized pump in a controlled fashion that comprises: a diagnostic component operatively connected to the pump to diagnose an operating condition associated with the pump, wherein ***the controller provides the control signal to the motor drive according to a setpoint and a diagnostic signal*** from the diagnostic

component according to the diagnosed operating condition in the pump. Applicants' claimed invention clearly relates to a controller that utilizes a diagnostic component to diagnose the operating conditions of a pump connected to the diagnostic component, wherein the controller supplies a control signal to a motor drive according to a setpoint and a diagnostic signal from the diagnostic component. Hays *et al.* is silent regarding these salient features of the invention as claimed.

Hays *et al.* discloses a method and apparatus for diagnosing a pump system. The Examiner (in the Final Office Action dated April 5, 2004) contends that Hays *et al.* discloses a controller for providing a control signal to a motor drive to operate a motorized pump in a controlled fashion, as set forth in the preamble of the subject claim, at col. 1, lines 39-47 and col. 6, lines 54-57. Contrary to the Examiner's contention however, col. 1, lines 39-47, suggests that Hays *et al.* pertains to *vibration monitoring equipment* rather than a ***controller*** that provides a control signal to a motor drive, and col. 6, lines 54-57, states that the driver source is an electric motor, diesel engine or turbine, and the driver source controller is a motor control system or variable speed drive and measurement devices for key processes and equipment monitoring variables. The noted passages, however, are silent regarding the provision of a control signal to the motor drive to operate the motorized pump in a controlled fashion.

The Examiner further asserts in the Final Office Action dated April 5, 2004, that Hays *et al.* discloses the substance of the subject claim at lines 1-3 of the abstract, and col. 10, lines 39-43. However, the indicated passages fail to disclose the fact that the *controller provides the control signal to the motor drive according to a setpoint and diagnostic signal* from the diagnostic component according to the diagnosed operating condition in the pump. Hays *et al.* simply discloses an apparatus and method for diagnosing rotating equipment, and that the diagnosis of a change in operating conditions of the pump and motor system is for the purposes of maintenance and changing the operation and control of pump and motor system. Hays *et al.* however, makes no mention that it is the controller that provides a control signal to the motor drive, and that the control signal communicated to the motor drive is based on both a setpoint, and a diagnostic signal obtained from a diagnostic component. Thus, it is submitted, Hays *et al.* fails to teach or suggest any of the limitations set forth in the subject claim.

Accordingly, in view of at least the foregoing, reversal of this rejection with respect to independent claim 40 and associated claims 41-42 is respectfully requested.

C. **Rejection of Claims 5, 7-9, 11-20 and 23-36 Under 35 U.S.C. §103(a)**

Claims 5, 7-9, 11-20 and 23-36 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Irvin (5,742,500) in view of Crane (US 4,584,654). This rejection should be withdrawn for at least the following reasons. Irvin and Crane, either individually or in combination, fail to teach or suggest all the limitations set forth in the subject claims.

> To reject claims in an application under §103, an examiner must establish a *prima facie* case of obviousness. A *prima facie* case of obviousness is established by a showing of three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) ***must teach or suggest all the claim limitations***. *See* MPEP §706.02(j). The ***teaching or suggestion to make the claimed combination*** and the reasonable expectation of success ***must be found in the prior art and not based on the Applicant's disclosure***. *See In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added).

i. ***Irvin and Crane, either alone or in combination, fail to teach or suggest each and every limitation set forth in independent claims 23, 34 and 35, and claims that depend there from.***

Independent claims 23, 34 and 35 recite similar limitations, namely: ***a controller providing the control signal to the motor drive according to a desired operating point within an allowable range of operation about a process setpoint.*** It is apparent that applicants' claimed invention provides a control signal to a motor drive, and upon receipt of the control signal the motor drive provides electrical power in a controlled fashion to a motor. Irvin and Crane, either alone or in combination, fail teach or suggest this exemplary feature of the invention as claimed.

The Examiner (in the Final Office Action dated April 5, 2004) concedes that Irvin fails to teach or suggest the limitation at issue. In an attempt to rectify the deficiencies presented by Irvin the Examiner attempts to utilize Crane. Crane however discloses a *monitoring* system and method, rather than a method and system to ***control*** a motor drive according to a desired operating point within an allowable range of operation about a process setpoint through utilization of a ***controller***. In particular, Crane utilizes *human intermediaries* to monitor the operation of all the pumping stations from a central location. *See*, col. 7, lines 45-46. It is thus apparent that Crane, rather than utilizing a controller to control a motor drive according to a desired operating point within an allowable range of operation about a process setpoint, utilizes a human intermediary – the operator – to facilitate *monitoring* of all the pumping stations from a central location. Consequently, Crane is clearly distinguishable from the invention as claimed. Accordingly, this rejection should be withdrawn with respect to independent claims 23, 34 and 35, as well as claims that depend there from. Further, as has been stated *supra*, since it is believed that independent claim 1 is in condition for allowance, withdrawal of the rejection with respect to claims 5, 7-9 and 11-20, which depend from independent claim 1, is also respectfully requested.

D. Rejection of Claims 37-39 Under 35 U.S.C. §103(a)

Claims 37-39 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Irvin (US 5,742,500) in view of Hays *et al.* (US 6,260,004). Withdrawal of this rejection is respectfully requested for at least the following reasons. Irvin and Hays *et al.*, either alone or in combination, do not teach or suggest each and every limitation set forth in the subject claims.

i. The combination of Irvin and Hay et al. fails to teach or suggest each and every limitation set forth in independent claim 37 and associated dependent claims.

Independent claim 37 recites ***a pump control system for automatically operating a pump driven by a motor in a controlled fashion*** wherein the system comprises ***a motor drive that provides electric power to operate the motor in a controlled fashion***

according to a motor control signal, and ***a controller that comprises a diagnostic component operatively connected to diagnose an operating condition associated with the pump***. It is apparent that the subject claim provides a pump control system that automatically operates a pump that is driven by a motor in a controlled fashion. The pump control system comprises a motor drive and a controller. The motor drive provides electric power to operate a motor in a controlled fashion according to a motor control signal received from the controller. The controller comprises a diagnostic component that diagnoses operating conditions associated with the pump that the controller utilizes to provide a control signal to the motor drive. The control signal that is communicated to the motor drive is thus based on both a setpoint and the diagnostic signal received from the diagnostic component. Neither Irvin nor Hay *et al.*, either individually or in combination, teach or suggest these novel features of applicants' claimed invention.

The Examiner (in the Final Office Action dated April 5, 2004) contends that Irvin discloses, at col. 1, lines 49, col. 1, lines 23-25 and figure 1, a pump control system that automatically operates a pump driven by a motor in a controlled fashion comprising a motor drive providing power to operate the motor in a controlled fashion according to a motor control signal. Applicants' representative avers to the contrary. Col. 1, line 49, provides a pump that has a variable-speed drive, and col. 1, lines 23-25, provides that transducers can measure power input to the system or to individual pump motors. As is evident, the noted passages fail to teach or suggest a pump control system that automatically operates a pump driven by a motor in a controlled fashion. At best the indicated passage provides a pump that might be a variable-speed drive pump, and that transducers *measure* power input to the system or to individual pump motors. Thus, it is submitted that Irvin fails to teach or suggest the limitation for which the Examiner utilizes the cited document, *viz.* a pump control system that automatically operates a pump driven by a motor in a controlled fashion that comprises a motor drive providing power to operate the motor in a controlled fashion according to a motor control signal.

In addition, the Examiner acknowledges that Irvin fails to disclose a controller comprising a diagnostic component operatively connected to diagnose an operating condition associated with the pump wherein the controller provides the control signal to the motor drive based on a setpoint and a diagnostic signal received from the diagnostic

component according to the diagnosed operating conditions in the pump. In order to rectify this lack of teaching in Irvin, the Examiner provides Hays *et al.*, lines 1-3 of the abstract, and col. 10, lines 39-43. However, as has been argued in connection with the rejection of claims 40-42 *supra*, Hays *et al.* does not disclose the fact that the controller provides a control signal to the motor drive based both on a setpoint and a diagnostic signal received from the diagnostic component.

In view of at least the foregoing, it is respectfully submitted that Irvin and Hays *et al.*, neither alone nor in combination, teach or suggest all the limitations of independent claim 37, and associated dependent claims. Accordingly, reversal of this rejection and allowance of the subject claims is respectfully requested.

E. Conclusion

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-42 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Respectfully submitted,
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VIII. Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1. A method of controlling a system having at least one motorized pump and an associated motor drive, comprising:

selecting a desired operating point within an allowable range of operation about a system setpoint according to performance characteristics associated with a plurality of components in the system; and

automatically controlling the system according to the desired operating point.

2. The method of claim 1, wherein the system comprises a motorized pump system having an electric motor operatively coupled with a pump, and a motor drive providing electrical power to the motor, and wherein the performance characteristics associated with a plurality of components in the system comprises efficiencies of at least two of the motor, the pump, and the motor drive.

3. The method of claim 2, further comprising obtaining the system setpoint and the allowable range of operation from a user.

4. The method of claim 2, wherein selecting the desired operating point comprises:

correlating at least two of motor efficiency information, pump efficiency information, and motor drive efficiency information in order to derive correlated system efficiency information; and

selecting the desired operating point as the optimum efficiency point within the allowable range of operation according to the correlated system efficiency information.

5. The method of claim 4, wherein controlling the system according to the desired operating point comprises providing a motor speed signal to the motor drive according to the desired operating point.

6. The method of claim 4, further comprising obtaining at least one of the efficiency information, the allowable range, and the system setpoint from a user.

7. The method of claim 4, further comprising obtaining at least one of the efficiency information, the allowable range, and the system setpoint from a host computer.

8. The method of claim 7, wherein the at least one of the efficiency information, the allowable range, and the system setpoint is obtained via a network.

9. The method of claim 8, wherein the at least one of the efficiency information, the allowable range, and the system setpoint is obtained via wireless communications.

10. The method of claim 4, further comprising obtaining at least a portion of one of the efficiency information, the allowable range, and the system setpoint from prior operation of the system.

11. The method of claim 1, wherein selecting the desired operating point comprises:

correlating component performance information associated with at least two components in the system in order to derive correlated system performance information; and

selecting the desired operating point as the optimum performance point within the allowable range of operation according to the correlated system performance information.

12. The method of claim 11, wherein controlling the system according to the desired operating point comprises providing a setpoint to a controller associated with the system according to the desired operating point.

13. The method of claim 11, further comprising obtaining at least one of the performance information, the allowable range, and the system setpoint from a user.

14. The method of claim 11, further comprising obtaining at least one of the performance information, the allowable range, and the system setpoint from a host computer.

15. The method of claim 14, wherein the at least one of the performance information, the allowable range, and the system setpoint is obtained via a network.

16. The method of claim 15, wherein the at least one of the performance information, the allowable range, and the system setpoint is obtained via wireless communications.

17. The method of claim 11, further comprising obtaining at least a portion of one of the performance information, the allowable range, and the system setpoint from prior operation of the system.

18. The method of claim 11, wherein the component performance information comprises at least one of life cycle cost information, efficiency information, life expectancy information, safety information, emissions information, operational cost information, MTBF information, noise information, and vibration information.

19. The method of claim 18, wherein the system comprises a motorized pump system for pumping fluid, having an electric motor operatively coupled with a pump, and a motor drive providing electrical power to the motor, wherein the component performance information comprises efficiency information related to at least two of the motor, the pump, and the motor drive, and wherein the correlated system performance information comprises cost information related to the system operational cost per unit of fluid pumped.

20. The method of claim 1, wherein the system comprises a motorized pump system having an electric motor operatively coupled with a pump, and a motor drive

providing electrical power to the motor, and wherein the performance characteristics associated with a plurality of components in the system comprises life expectancies of at least two of the motor, the pump, and the motor drive.

21. The method of claim 1, wherein the system comprises a motorized pump system having an electric motor operatively coupled with a pump, and a motor drive providing electrical power to the motor, and wherein the performance characteristics associated with a plurality of components in the system comprises cost of operation associated with at least two of the motor, the pump, and the motor drive.

22. The method of claim 1, wherein selecting the desired operating point comprises measuring at least one process variable from a sensor associated with the system.

23. A control system for controlling a process having a pump with an associated motor, the control system comprising:

a motor drive providing electrical power to the motor in a controlled fashion according to a control signal; and

a controller providing the control signal to the motor drive according to a desired operating point within an allowable range of operation about a process setpoint;

wherein the controller selects the desired operating point according to performance characteristics associated with a plurality of components in the process.

24. The control system of claim 23, wherein the performance characteristics associated with a plurality of components in the process comprises efficiencies of at least two of the motor, the pump, and the motor drive.

25. The control system of claim 23, wherein the controller is adapted to correlate at least two of motor efficiency information, pump efficiency information, and motor drive efficiency information in order to derive correlated process efficiency information,

and to select the desired operating point as the optimum efficiency point within the allowable range of operation according to the correlated process efficiency information.

26. The control system of claim 25, wherein the controller provides the control signal as a motor speed signal to the motor drive according to the desired operating point.

27. The control system of claim 25, further comprising a user interface, wherein the controller obtains at least one of the efficiency information, the allowable range, and the process setpoint from a user via the user interface.

28. The control system of claim 25, wherein the controller comprises a network interface operatively connecting the controller with a host computer through a network, and wherein the controller obtains at least one of the efficiency information, the allowable range, and the process setpoint from the host computer via the network.

29. The control system of claim 25, wherein the controller comprises a wireless communication device, and wherein the controller obtains the at least one of the efficiency information, the allowable range, and the process setpoint via wireless communications using the wireless communications device.

30. The control system of claim 25, wherein the controller obtains at least a portion of one of the efficiency information, the allowable range, and the process setpoint from prior operation of the process.

31. The control system of claim 23, wherein the controller is adapted to correlate component performance information associated with at least two components in the process in order to derive correlated process performance information, and to select the desired operating point as the optimum performance point within the allowable range of operation according to the correlated process performance information.

32. The control system of claim 31, wherein the controller provides the control signal as a motor speed signal to the motor drive according to the desired operating point.

33. The control system of claim 31, wherein the component performance information comprises at least one of life cycle cost information, efficiency information, life expectancy information, safety information, emissions information, operational cost information, MTBF information, noise information, and vibration information.

34. A control system for controlling a process having a pump with an associated motor, the control system comprising:

a motor drive adapted to provide electrical power to the motor in a controlled fashion according to a control signal; and

means for providing the control signal to the motor drive according to a desired operating point within an allowable range of operation about a process setpoint; and

means for selecting the desired operating point according to performance characteristics associated with a plurality of components in the process.

35. A control system for controlling a process having at least one motorized pump and an associated motor drive, comprising:

means for selecting a desired operating point within an allowable range of operation about a process setpoint according to performance characteristics associated with a plurality of components in the process; and

means for controlling the process according to the desired operating point.

36. The control system of claim 35, wherein the process comprises a motorized pump system having an electric motor operatively coupled with a pump, and a motor drive providing electrical power to the motor, and wherein the means for selecting a desired operating point comprises:

means for correlating at least two of motor efficiency information, pump efficiency information, and motor drive efficiency information in order to derive correlated process efficiency information; and

means for selecting the desired operating point as the optimum efficiency point within the allowable range of operation according to the correlated process efficiency information.

37. A pump control system for automatically operating a pump driven by a motor in a controlled fashion, comprising:

a motor drive providing electric power to operate the motor in a controlled fashion according to a motor control signal; and

a controller comprising a diagnostic component operatively connected to diagnose an operating condition associated with the pump;

wherein the controller provides the control signal to the motor drive according to a setpoint and a diagnostic signal from the diagnostic component according to the diagnosed operating condition in the pump.

38. The pump control system of claim 37, wherein the diagnostic component performs signature analysis of at least one sensor signal from a sensor associated with the pump in order to diagnose the operating condition associated with the pump.

39. The control system of claim 38, wherein the at least one sensor signal is related to one of flow, pressure, current, noise, vibration, and temperature associated with the pump.

40. A controller for providing a control signal to a motor drive to operate a motorized pump in a controlled fashion, comprising:

a diagnostic component operatively connected to the pump to diagnose an operating condition associated with the pump;

wherein the controller provides the control signal to the motor drive according to a setpoint and a diagnostic signal from the diagnostic component according to the diagnosed operating condition in the pump.

41. The controller of claim 40, wherein the diagnostic component performs signature analysis of at least one sensor signal from a sensor associated with the pump in order to diagnose the operating condition associated with the pump.

42. The controller of claim 41, wherein the at least one sensor signal is related to one of flow, pressure, current, noise, vibration, and temperature associated with the pump.

IX. Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

None.

X. Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

None.